



DIVERSITY, SPECIES RICHNESS AND EVENNESS OF BUTTERFLY IN TARAI REGION OF KUMAON ZONE

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ABSTRACT

Butterflies are one of the most conspicuous species of earth's biodiversity. India is home of 1504 species of butterflies. Kumaon zone is filled with biodiversity due to its suitable vegetation, ecological condition and humid area. Butterflies are also monitored to indicate climatic and ecological changes, hence butterflies are now studied as Bio indicator. The purpose of the study was to describe diversity, species richness and evenness of butterfly in tarai region of Kumaon zone.

KEYWORDS: Butterfly, Diversity, Lepidoptera, Kumaon Zone, richness, Evenness, Tarai Region

INTRODUCTION

India is home of 1504 species of butterflies (Tiple, 2011). Across the state Uttarakhand 323 butterfly species have been found. Butterflies play major role in environment as pollinators (Ghazanfar et al, 2016). About 80% pollination is done by butterfly. Butterflies also called flagship species because of its high contribution in food chain to a healthy environment. Due to sensitivity to variable environmental condition, they are also monitored to indicate climatic and ecological changes, hence butterflies are now studied as living ecological component. The abundance and diversity of butterfly is linked with the availability of different host plants, as a result dearth in butterfly diversity is not only affected by atmospheric changes but the more directly consequences of low host plant diversity. Butterflies are altitude restricted and their diversity restricted in season to season. Tarai region of Kumaon zone diversified in terms of flora, such as *Mangifera indica*, *Musa paradisiacal*, *Morus alba*, *Ziziphus mauritiana*, *Eucalyptus gloulus*, *Trifolium alexandrinum*, *Bressica* spe., *Citrus* spe., *Shorea robusta* etc. The aim of the work is to explore the diversity, richness and evenness of butterfly in tarai region of Kumaon zone (Uttarakhand).

MATERIALS AND METHODS

Study Area

The present work is conducted in tarai region of Kumaon zone. Tarai region of Kumaon zone diversified in terms of flora. It is located at the lowland region in southern Nepal and northern India that lies south of the outer foothills of the Himalayas, the Siwalik hills, and north of the Indo-Gangetic plain. The latitude of Tarai region of Kumaon zone is 29.201491° N and the 79.196732° E longitude. The area covered different vegetation, tropical and sub-tropical vegetation dominated by woody species, viz. *P. guajava*, *T. grandis*, *Z. mauritiana*, *Citrus species*, *M. indica*, *A. lebbek*, *R. fruticosus*, *A. amara*, *C. roseus*, *Musa species* and *Z. mauritiana*.



MAP OF THE STUDY AREA

Sampling Method

The line transect method was used for butterfly observation. Observation was done twice in a month. All transects were observed between 10:00am to 2:00 pm. Morphological character mainly observed for identify butterfly species. Size, and shape, colour pattern, and their body design were considered in identification of species of butterflies. Photos of butterflies were taken by using Canon EOS 200DII camera and recognition was done as suggested by Kehimkar (2008, 2016), Singh AP. (2010), Smetacek (2016), and Sondhi (2018). No samples were collected during this study.

Data Analysis

1. Shannon-Wiener diversity Index

The species diversity was calculated using Shannon Wiener Index (H)

$$H(S) = -\sum_{s=1}^t p_i \log p_i$$

Where p_i = fraction of total population made up of species i ,

t = total number of species encountered

s = proportion of species

2. Margalef's Index

Species richness was calculated using Margalef's Index.

Margalef's Index = $(S'-1)/\ln n$

Where S' = total number of species

n = total number of individuals

3. Pielou's Index

Species evenness was calculated using Pielou's Index.

Pielou's Index (E') = $H'/\ln S$

Where H' = Shannon-Wiener diversity

S = total number of species.

RESULT

A total of 162 individuals belonging to 80 species of butterflies belonging to six families were recorded during the study period. Out of these, 20 species (25% of total species) species each belonged to the families Pieridae and 15 species (18.75 % of total species) to Lycaenidae, 24 species (30% of total species) to Nymphalidae, 8 species (10% of total species) to Papilionidae and 7 species (8.75% of total species) to family Hesperidae, 6 (7.5 % of total species) species to family Danaidae (Fig 1). Shannon-Wiener diversity Index of 1.6581 indicates the medium butterfly diversity for the study area which is also supported by high value of Pielou's Index ($J' = 0.9254$) (table3). Besides, Margalef's Index (0.9827) indicates medium species diversity for the study area (table3).

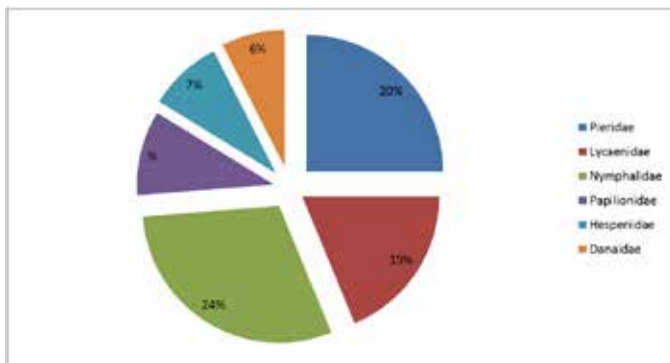


Fig 1: Pie chart of Butterfly families were observed in Tarai region of kumaon zone.

s.n.	Family	Total no. of species	% of species	Total no. of individual	% of individual
1	Pieridae	20	25%	50	30.86%
2	Lycaenidae	15	18.75%	32	19.75%
3	Nymphalidae	24	30%	30	18.51%
4	Papilionidae	8	10%	20	12.34%
5	Hesperidae	7	8.75%	10	6.17%
6	Danaidae	6	7.5%	20	12.34%
total		80	100%	162	99.97%

Table 1: Percent distribution of relative number of individuals and species of different families of butterfly observed during work.

Species	No. of species (p)	pl	ln(pl)	Pi*ln(pl)	-pi*ln(pl)
Pieridae	20	0.25	1.386	0.3465	0.3465
Lycaenidae	15	0.1875	1.676	0.3134	0.3134
Nymphalidae	24	0.3	1.204	0.3612	0.3612
Papilionidae	8	0.1	2.303	0.2302	0.2302
Hesperidae	7	0.087	2.442	0.2125	0.2125
Danaidae	6	0.075	-2.590	0.1943	0.1943
total	80				1.6581

Table 2: Shannon-Wiener Diversity indices of butterfly diversity in Tarai region of kumaon zone.

Pielou's Index	$(E') = H'/\ln S$	Evenness
	$J = 1.6581/\ln 6$	0.9254
Margalef's Index	$D = (S'-1)/\ln n$	Richness
	$D = (6-1)/\ln 162$	0.9827

Table 3: Pielou's and Margalef's Diversity indices of butterfly evenness and richness in Tarai region of kumaon zone.

No. of species	
No. of species	80
No. of individuals	162
Abundance	162
Shanon	1.6581
Evenness	0.9254
Margalef	0.9827

Table 4: Diversity indices of butterfly in Tarai region of kumaon zone.

S.No.	Scientific Name	Family	Common Name
1	<i>Junonia lemonias</i>	Nymphalidae	Lemon Pansy
2	<i>Junonia orithya</i>	Nymphalidae	Blue Pansy
3	<i>Junonia almana</i>	Nymphalidae	Peacock Pansy
4	<i>Euthalia aconthea</i>	Nymphalidae	Common baron
5	<i>Euthalia patala</i>	Nymphalidae	Grand duchess
6	<i>Hypolimnys bolina</i>	Nymphalidae	Common eggfly
7	<i>Neptis hylas</i>	Nymphalidae	Common sailer
8	<i>Vanessa caschmirensis</i>	Nymphalidae	Indian tortoiseshell
9	<i>Junonia iphita</i>	Nymphalidae	Chocolate pansy
10	<i>Phalantha phalantha</i>	Nymphalidae	Common Leopard
11	<i>Vanessa cardui</i>	Nymphalidae	Painted lady
12	<i>Sephisia dichroa</i>	Nymphalidae	Western courtier
13	<i>Athyma opalina</i>	Nymphalidae	Himalayan sergeant
14	<i>Ariadne merione</i>	Nymphalidae	Common castor
15	<i>Vanessa indica</i>	Nymphalidae	Indian red admiral
16	<i>Kallima inachus</i>	Nymphalidae	Orange oakleaf
17	<i>Symbrenthia</i>	Nymphalidae	Jester
18	<i>Uthalia nais</i>	Nymphalidae	Baronet
19	<i>Ypthima</i>	Nymphalidae	Common five ring
20	<i>Callerebia nirmala</i>	Nymphalidae	Common Argus

21	<i>Callerebia annada</i>	Nymphalidae	Ringed Argus
22	<i>Pantoporia hordonia</i>	Nymphalidae	Common lascar
23	<i>Charaxes agrarius</i>	Nymphalidae	Common nawab
24	<i>Melanitis leda</i>	Nymphalidae	Common evening brown
25	<i>Junonia iphita</i>	Danaidae	Blue Tiger
26	<i>Danaus chrysippus</i>	Danaidae	Plain Tiger
27	<i>Danaus genutia</i>	Danaidae	Stripped Tiger
28	<i>Euploea core</i>	Danaidae	Common Indian Crow
29	<i>Parantica sita</i>	Danaidae	Chestnut tiger
30	<i>Parantica aglea melanoides</i>	Danaidae	Glassy tiger
31	<i>Catopsilia pyranthe</i>	Pieridae	Mottled Emigrant
32	<i>Catopsilia pomona</i>	Pieridae	Common Emigrant
33	<i>Leptosia nina</i>	Pieridae	Psyche
34	<i>Belenois aurota</i>	Pieridae	Pioneer
35	<i>Delias eucharis</i>	Pieridae	Common Jezebel
36	<i>Aporia agathon</i>	Pieridae	Great blackvein
37	<i>Cepora nerissa</i>	Pieridae	Common gull
38	<i>Pieris brassicae</i>	Pieridae	Large cabbage white
39	<i>Pieris canidia</i>	Pieridae	Indian Cabbage White
40	<i>Eurema andersonii</i>	Pieridae	One spot grass yellow
41	<i>Eurema laeta</i>	Pieridae	Spotless grass yellow
42	<i>Eurema hecabe</i>	Pieridae	Common Grass Yellow
43	<i>Eurema blanda</i>	Pieridae	Three Spot Grass Yellow
44	<i>Delias belladonna</i>	Pieridae	Hill jezebel
45	<i>Pareronia hippia</i>	Pieridae	Indian Wanderer
46	<i>Colias electo fieldi</i>	Pieridae	African clouded yellow
47	<i>Pontia daplidice</i>	Pieridae	Bath white
48	<i>Gonepteryx rhamni nepalensis</i>	Pieridae	Common brimstone
49	<i>Alias fieldii</i>	Pieridae	Dark clouded yellow
50	<i>Eurema brigitta</i>	Pieridae	Small grass yellow
51	<i>Papilio polytes romulus</i>	Papilionidae	Common Mormon
52	<i>Papilio demoleus</i>	Papilionidae	Common Lime
53	<i>Papilio protenor</i>	Papilionidae	Spangle

54	<i>Byasa dasarada</i>	Papilionidae	Great windmill
55	<i>Aporia agathon</i>	Papilionidae	Great blackvein
56	<i>Pachliopta aristolochiae</i>	Papilionidae	Common Rose
67	<i>Graphium sarpedon</i>	Papilionidae	Common Bluebottle
58	<i>Papilio paris</i>	Papilionidae	Paris peacock
59	<i>Poritia hewitsoni</i>	Lycaenidae	Himalayan common gem
60	<i>Catochrysops strabo</i>	Lycaenidae	Forget-me-not
61	<i>Lampides boeticus</i>	Lycaenidae	Pea blue
62	<i>Pseudozizeeria maha</i>	Lycaenidae	Pale grass blue
63	<i>Jamides celeno</i>	Lycaenidae	Common Cerulean
64	<i>Neopithecops zalmora</i>	Lycaenidae	Quaker
65	<i>Castalius rosimon</i>	Lycaenidae	Common Pierrot
66	<i>Heliophorus sena</i>	Lycaenidae	Sorrel sapphire
67	<i>Tarucus nara</i>	Lycaenidae	Striped pierrot
68	<i>Talicauda nyseus</i>	Lycaenidae	Red pierrot
69	<i>Spindasis ictis</i>	Lycaenidae	Common shot silverline
70	<i>Leptotes plinius</i>	Lycaenidae	Zebra blue
71	<i>Acytolepis pushpa</i>	Lycaenidae	Himalayan common hedge blue
72	<i>Arhopala amantes</i>	Lycaenidae	Large Oakblue
73	<i>Arhopala atrax</i>	Lycaenidae	Indian Oakblue
74	<i>Parnara spp.</i>	Hesperiidae	Parnara Swift
75	<i>Telicota bambusae</i>	Hesperiidae	Dark palm dart
76	<i>Polytremis eltola</i>	Hesperiidae	Yellow spot swift
77	<i>Spialia galba</i>	Hesperiidae	Indian Skipper
78	<i>Suastus gremius</i>	Hesperiidae	Indian Palm Bob
79	<i>Parnara guttatus mangala</i>	Hesperiidae	Himalayan straight swift
80	<i>Barbo bevani</i>	Hesperiidae	Lesser rice swift

Table5: Checklist of butterflies found in Tarai region of kumaon zone

CONCLUSION

A total of 80 species of butterflies belonging to five families were collected. Observation made in the present study concluded that Nymphalidae was the most dominant family in terms of number of species followed by Pieridae, Lycaenidae, Papilionidae, Hesperiidae, and Danaidae. The study area covered different vegetation, such wide varieties of food plants, nectar plants, breeding habitat which leads a strong base for butterfly diversity. Maximum number of butterfly and individuals of butterflies were recorded during sunny season during feeding and flying. Butterflies are very sensitive to their

host plant availability, if the diversity of host plant could be increased, the diversity of butterflies may also affect.

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